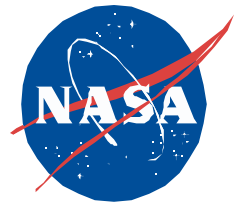




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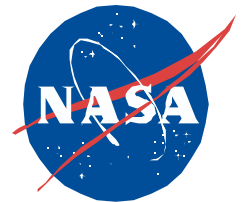
# **STS-110 / 8A Flight Readiness Review**

**Heather M. Mitchell  
Glenn C. Lutz  
EVA Project Office  
Johnson Space Center  
March 26, 2002**

H. Mitchell  
G. Lutz  
March 26, 2002



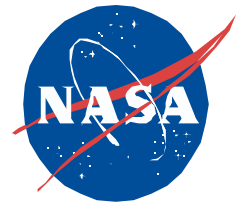
# Agenda



- **Overview**
- **EMU**
- **Tools and Crew Aids**
- **Fit Checks**
- **Significant Anomalies Since Previous FRR**
  - Metox
  - EMU Sublimator Flooding (STS-109)



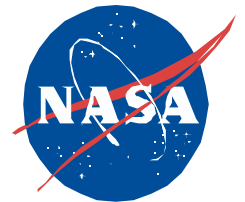
## 8A EVA Mission Overview



- **EVA Capability**
  - Consumables to support 10.2 psi following EVA's
    - Four scheduled EVA's from the joint airlock
    - One unscheduled EVA from the joint airlock
    - Two unscheduled EVA's from the orbiter airlock
    - Two contingency EVA's for orbiter, RMS, and ODS contingencies
- **EVA Training**
  - Crew is fully trained on all EVA tasks
  - All planned tasks can fit within scheduled 6 hours 30 minutes timeline



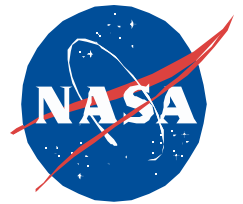
## 8A EVA Mission Overview (cont.)



- **EVA1 (Flight Day 4) – 6 hours 30 minutes**
  - Install forward Module-to-Truss Structure (MTS) struts
  - Deploy aft lab tray
    - Demate S0 Launch-to-Activation (LTA) cables
  - Install forward port and starboard avionics umbilicals
  - Install Circuit Isolation Devices (CID's) 7 and 8 on S0
  - Install Trailing Umbilical System 1 (TUS1) cable to MT
  - Remove port drag link
  - Get-ahead options available if EVA is ahead of schedule. Both are planned EVA2 tasks.
    - Install TUS2 cable to MT
    - Stow port drag link



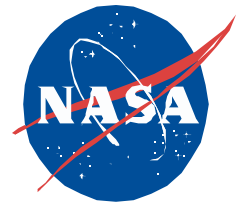
## 8A EVA Mission Overview (cont.)



- **EVA 2 (Flight Day 6) – 6 hours 30 minutes**
  - Install aft Module-to-Truss Structure (MTS) struts
  - Install Trailing Umbilical System 2 (TUS2) cable to MT
  - Remove and stow starboard drag link
  - Remove and stow keels
  - Remove DDCU thermal cover (Bay 04/Face1)
  - Install airlock handrail
  - Get-ahead options available if EVA is ahead of schedule. Both are planned EVA3 tasks.
    - Install J300 panel connectors
    - Install airlock spur



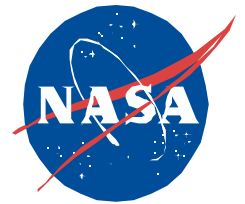
## 8A EVA Mission Overview (cont.)



- **EVA3 (Flight Day 7) – 6 hours 30 minutes**
  - Install J300 panel connectors
  - Reconfigure J400 PDGF connectors
  - Release MT launch restraints
  - Remove RPCM thermal cover
  - Release load on Lab Cradle Assembly (LCA) capture claw
  - Depress starboard SSAS ready-to-latch indicators
  - Tool Transfers
  - Install airlock spur



## **8A EVA Mission Overview (cont.)**

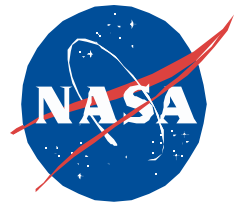


- **EVA 4 (Flight Day 9) - 6 hours 30 minutes**
  - Install Node3 EVA light
  - Release LCA guide cones
  - Assemble Portable Work Platform (PWP)
  - Depress port SSAS ready-to-latch indicators
  - Remove DDCU thermal cover (port wedge face)
  - Install lab EVA light
  - Deploy Extravehicular Charged Particle Directional Spectrometer (EV-CPDS)
  - Install MT energy absorbers
  - Remove MT/MBS nut covers
  - Deploy Node1 swing arm
  - Install S0 handrails
  - Take closeout photos
  - Set-up APFR for UF-2



- **Three EMU's Manifested/Three EMU's On-orbit**
  - UF-1 stage configuration
    - One Medium ORU on-orbit since UF-1 (Bursch/Walheim)
    - One Large ORU on-orbit since UF-1 (Walz)
    - One Extra large ORU on-orbit since 7A.1 (Onufrienko)
      - Returned on 8A
  - EMU's launched on 8A
    - One Extra-large ORU (Smith)
      - Stays on-orbit (Onufrienko)
    - One Large pivoted (Ross)
    - One Extra-large ORU (Morin)
  - EMU's returned on 8A
    - One Extra-large ORU (Onufrienko)
    - One Large pivoted (Ross)
    - One Extra-large ORU (Morin)



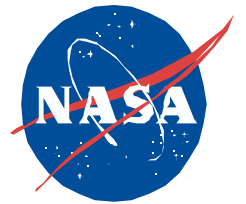


- **EMU/SAFER First Flight Items**
  - Vent port plugs for the Portable Life Support System (PLSS)
    - Provides a protective cover for the vent ports
    - Allows EMU storage on orbit without Metox cans installed
- **EMU Open FIAR's, Waivers, or Certification - None**
- **One SAFER Manifested / Two SAFER's On-orbit - SAFER swap planned**
- **SAFER Anomalies - None**
- **SAFER Open Waivers or Certifications - None**



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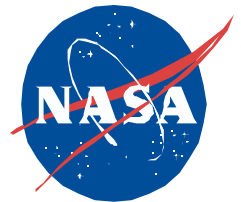
# **EVA Tools and Crew Aids Manifest Summary**



- **EVA Tools and Crew Aids First Flight Items**
  - MT Energy Absorber (MTEA)
  - Portable Work Platform (PWP)
    - Consists of the Temporary Equipment Restraint Aid (TERA), PFR Workstation and APFR
- **Non-GFE EVA Hardware First Flight Items - None**



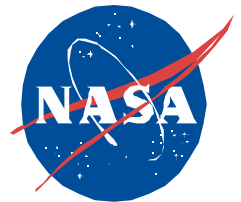
# **EVA Tools and Crew Aids Manifest Summary (cont.)**



- **EVA Tools and Crew Aids Left On-Orbit**
  - Adjustable Fuse Tether
  - Hydrazine Detection Kit
  - Right Angle Drive (2)
  - EVA On-orbit handrails (3)
  - Modular Mini-Workstation (MMWS) Gimbal Assembly (2)
  - Orbit Installed Gap Spanner (3)
  - ORU Tether Assembly (3)
  - Power Supply Assembly (PSA) 28V Utility Adapter
  - SAFER
  - 10.3" Wobble Socket Extension
  - Tether Reel (TERA PWP)
  - Torque Wrench and Bag
  - EVA Helmet Light
  - Helmet light bulb (7)
  - Short and Long Wire Ties (46)
  - High-strength Bridge Clamp
  - Push-Button Articulating Socket
  - Portable Foot Restraint (PFR)
  - Short Allen Driver (T-handle)
  - EMU Cuff Checklist Bands (3)



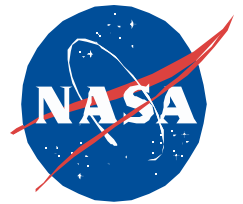
# **EVA Tools and Crew Aids Manifest Summary (cont.)**



- **EVA Tools and Crew Aids Returned**
  - Adjustable Fuse Tether
  - Hydrazine Detection Kit
  - EVA Helmet Interchangeable Light
  - MMWS Gimbal Assembly (2)
  - SAFER
  - EMU Cuff Checklist Bands (3)
  - Retractable Tether (2)
  - Long Allen Driver (T-handle)
  - ISS-4 (Bursch) Contaminated Gloves
- **Standard contingency tools in port TSA**
- **PFR mounted on sill (Bay 2 port)**
- **Standard complement of slidewires, safety tethers, crew hook locks, and winches in payload bay**
- **EVA Tools and Crew Aids Open FIAR's, Waivers, or Certifications - None**



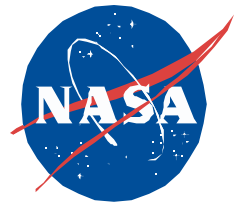
# Fit Checks Status



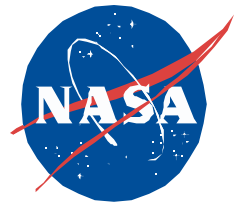
- **Tool-to-Tool Fit Checks (114 interfaces)**
  - 100 percent complete for payload bay, middeck, TSA and S0 stowed tools
- **Tool-to-Interface Fit Checks (124 tasks)**
  - 96 percent complete (119/124 tasks)
- **Tool-to-Interface Fit Checks not performed**
  - The incomplete portions of the following fit checks were determined to be low risk and acceptable for flight
    - Airlock spur deploy
    - Port and Starboard Fluid Umbilicals deploy
    - MT Roller Suspension Unit (RSU) replacement
    - Connector Cap Removal and Stowage on the Forward S0 Avionics Panels
    - Gap Spanners Not Installed on the lab
- **Sharp Edge Inspections**
  - 100 percent complete on S0 / MT
  - Final inspection planned during payload bay walk down on April 1, 2002



# Significant Anomalies Since Previous FRR



- **ISS-4 Battery Charger “Lo Slope” Error Message**
  - Checkout of the two batteries planned on-orbit to determine if the batteries are deeply discharged or if there are real problems with the batteries or charger. (ECD 4/4/02)
    - Workarounds available to use one of the remaining ISS chargers or use the middeck battery charger if there are charger problems
    - Sufficient batteries available to provide one fault tolerance if there are battery problems
    - Not a constraint to flight
- **SSRMS Wrist Roll**
  - EVA readiness will be presented during the ISS Program Office presentation



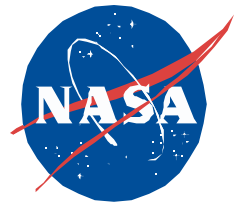
## **Metox Odor During Stage UF1**

### **Background**

- **On February 20, 2002, a “Sweet” odor was documented and an investigation was begun to address why this occurred**
- **The odor was addressed and crew procedures have been modified to avoid reoccurrence**
  - Canisters s/n 0009/0010 were used outside of design intent
    - Canisters stowed in regenerator with purge flow for up to seven months saturating the 0.25 lbs. of charcoal in each canister
      - Regeneration cycle was halted for an unrelated noise investigation and subsequently not reinitiated
    - Trace contaminants absorbed by the charcoal during the exposure time were released back into the equipment lock during the first ~3 hours of regeneration prior to shutdown by the crew
  - CHIT TI0125 issued to correct on-orbit procedures in the future
    - Prohibits stowage of the Metox canisters in the CO<sub>2</sub> removal box or Metox regenerator



## Significant Anomalies (cont.)

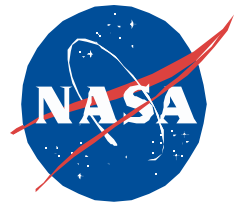


- **The following concerns surfaced during this investigation and have been addressed**
  - Metox ( $A_{g2}O$ ) could act as a catalyst and convert specific ISS environment constituents into reaction by-products that are hazardous to crew health (i.e., above SMAC valves)
    - Note: Constituents making up the ISS environment have increased from approximate 124 compounds at the time of Metox qualification to approximate 600 compounds currently
    - Testing and analysis have determined that catalytic conversion is well below hazardous levels
  - Flammability concerns were raised on charcoal at elevated temperatures
    - Configuration as well as material level testing has demonstrated adequate margin from a flammability perspective
  - Release of environmental constituents into EMU post regeneration
    - Analysis has confirmed that no credible scenario exists to release constituents into EMU environment post regeneration
  - Performance degradation due to additional constituents now on ISS
    - Negligible (<1%) degradation has been analyzed due to higher contaminant loading at ISS





## **Significant Anomalies (cont.)**



- **A parallel effort was implemented to provide a logistics plan utilizing LiOH canisters (CCC's) in place of Metox. This plan requires additional CCC's to be manifested and flown.**

### **Current Issues**

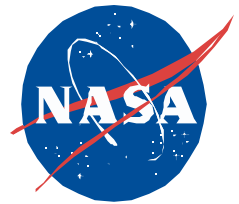
- **All issues for safe resumption of nominal Metox use/regeneration have been addressed and agreed to by U. S. Safety community**
- **Coordination with Russian International Partners (IP's) is continuing**

### **Plans for EVA**

- **LiOH will be manifested, flown, and available to be utilized for EVA operations while coordination/resolution activities continue with the IP's**



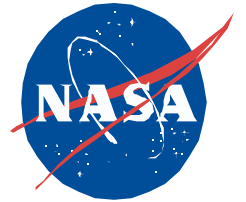
## **Significant Anomalies (cont.)**



- **On STS-109 an EMU leaked water during prebreathe operations in the orbiter airlock making that unit temporarily incapable of supporting planned EVA's**
  - Preliminary assessment has established that this anomaly occurred due to a voltage spike received from the Orbiter power supply (ALPS)
- **The EMU and ALPS have a known compatibility problem (similar occurrence seen in May 1996)**
  - The EMU fan speed control can cause voltage spikes on the ALPS supply lines
  - Voltage spikes in duration of 100 milliseconds above 23 volts can cause a valve on the EMU to open, flooding the sublimator
  - Corrective action for this occurrence is a new configuration power supply which has been implemented for this flight
- **The power supply on ISS is acceptable for use during station based activities**
  - The ISS Power Supply assembly has been shown to meet the ICD-4-0075-0C-0 requirement of 22 volts maximum
  - The flooding anomaly will not occur with voltages up to 22 volts



## **Significant Anomalies (cont.)**

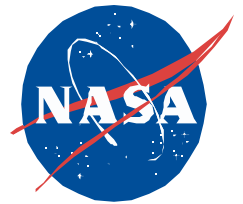


- **The EMU is Go for EVA on ISS with no modifications**
- **The EMU is Go for EVA on SSP with ALPS change out to new configuration**
- **Work around exists in the event this anomaly is ever seen again by operating EMU on battery power during EMU checkout**



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# STS-110/8A FRR



- **There are no EVA exceptions for STS-110/8A FRR**
- **The EVA Project Office is ready to proceed with the launch of STS-110/8A and subsequent on-orbit operations pending completion of final payload bay walkdown and final sharp edge inspection**

*Original signed by:*

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**G. Allen Flynt**  
**Manager, EVA Project Office**



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# Backup

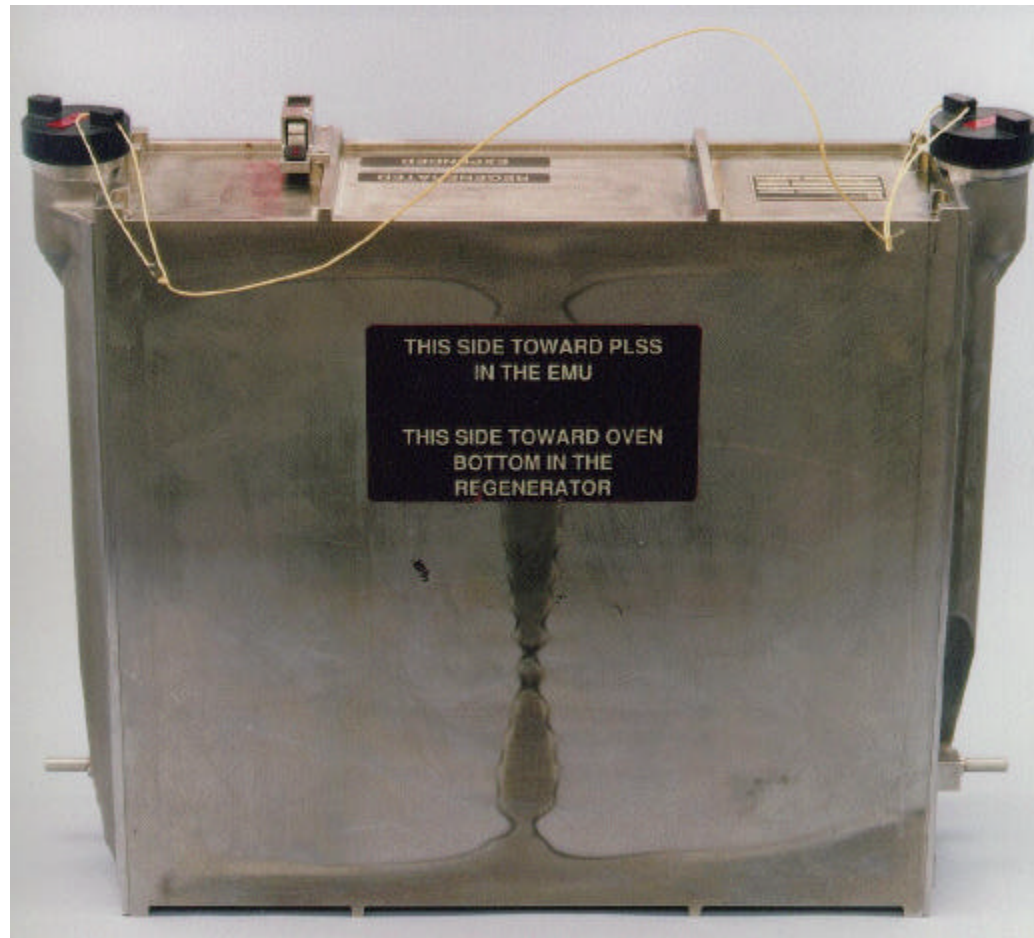
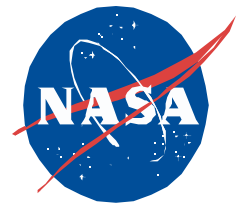
EVA-21

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# METOX



Metox Canister

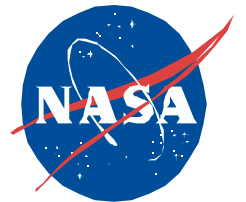
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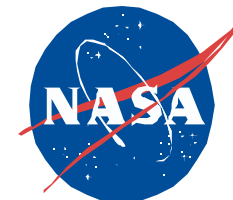
# METOX



Metox Regenerator

EVA-23

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## METOX SYSTEM SCHEMATIC DIAGRAM

